

**Amendments to the Specification:**

Please replace the paragraph beginning at page 10, line 5, with the following rewritten paragraph:

It should be understood that the present invention does not exclude the situation in which the illumination chamber **103** and the reaction chamber **105** of the reaction cell are partially or fully overlapping each other. FIG. 1C ~~illustrates~~ schematically illustrates a reactor system having a reaction cell that accommodates light illumination and chemical/biochemical reaction in one chamber **143**. Such an overlapping scheme is preferred in certain circumstances when, for example, the overlapping allows simpler and/or cheaper reactor devices to be fabricated. In embodiments having a full overlap, the term reaction cell and reaction chamber can be used interchangeably as there is a single combined chamber.

Please replace the paragraph beginning at page 13, line 12, with the following rewritten paragraph:

FIG. 3A illustrates an exploded perspective view of a flowthrough multi-cell reactor device, a preferred embodiment of the present invention. In this device, a microfluidic template **310** is sandwiched between a first window plate **351** and a second window plate **361**. Preferably, the microfluidic template **310** is made of silicon when reaction cells are small. In this case, the preferred distance between adjacent reaction cells is in the range of 10 to 5,000  $\mu\text{m}$ . More preferably, the distance is in the range of 10 to 2,000  $\mu\text{m}$ . Yet more preferably, the distance is in the range of 10 to 500  $\mu\text{m}$ . Even more preferably, the distance is in the range of 10 to 200  $\mu\text{m}$ . The silicon microfluidic template **310** is formed using etching processes which are well ~~know~~ known to those skilled in the art of semiconductor processes and microfabrication (Madou, M., *Fundamentals of Microfabrication*, CRC Press, New York, (1997)). The top surface **313** of the microfluidic template **310** is preferably coated with silicon dioxide, which can be made by either oxidation or evaporation during a fabrication process. When the reaction cells are large, e.g. the distance between adjacent reaction cells is larger than 5,000  $\mu\text{m}$ , plastic materials are preferred. Plastic materials may also be preferred for large quantity production of the multi-cell reactor device even when the distance between adjacent reaction cells is less than 5,000  $\mu\text{m}$ . Preferred

plastics include but are not limited to polyethylene, polypropylene, polyvinylidene fluoride, and polytetrafluoroethylene. The plastic microfluidic template 310 can be made using molding methods, which are well known to those skilled in the art of plastic processing. In one aspect of the present invention, the first window plate 351 and the second window plate 361 are preferably made of transparent glass and are bonded with the microfluidic template 310. In another aspect of the present invention, the first window plate 351 and the second window plate 361 are preferably made of transparent plastics including but not limited to polystyrene, acrylic, and polycarbonate, which have the advantage of low cost and easy ~~handling~~ handling.

Please replace the paragraph beginning at page 14, line 6, with the following rewritten paragraph:

The microfluidic device shown in FIG. 3A embodies the two-level device configuration shown in FIG. 2A. The topographic structure of the bottom part of the microfluidic template 310, which cannot be seen in the figure, is a mirror image of the top part, which can be seen in the figure. FIG. 3B schematically illustrates the cross-section of the microfluidic device shown in FIG. 3A and the operation principle of the device. The first window plate 351 and the second window plate 361 are bonded or attached with the microfluidic template 310 at the bonding areas 311 and 315 of the microfluidic template 310. Bonding or attaching can be done by covalent or non-covalent methods. During a reaction involving the use of photogenerated reagents, a feed solution 331 containing photogenerated reagent precursor flows from an inlet 321 through an inlet restriction gap 322 into an illumination chamber 323. After an exposure to h<sub>v</sub> in the illumination chamber 323, active chemical reagents are produced and the resultant reactive solution 332 flows through a connection channel 324 into a reaction chamber 325. In the reaction chamber 325 the reactive solution 332 is in contact with immobilized molecules 340 on the top surface 313 of the microfluidic template 310. Chemical reactions take place between the active reagents in the reactive solution 332 and the immobilized molecules 340. Then the solution flows through an outlet restriction gap 326 into the outlet 327 as an effluent 333.

Please replace the paragraph beginning at page 16, line 11, with the following rewritten paragraph:

FIG. 4A illustrates an exploded perspective view of a high-density flowthrough multi-cell reactor device that embodies the two-level device configuration shown in FIG. 2A. FIG. 4B illustrates schematically the cross-section of the device shown in FIG. 4A. Compared to the device structure shown in FIG. 3A the device structure shown in FIG. 4A has a higher area density of the reaction chamber 425 and illumination chamber 423. Inlet channel 421 and outlet channel 427 are embedded in the mid-section of the microfluidic template 410 so as to permit the upper and lower surface areas of the microfluidic template 410 to be fully utilized for implementing reaction and illumination chambers, respectively. During a reaction involving the use of photogenerated reagents, a feed solution 431 containing photogenerated reagent precursor flows from an inlet duct 422 into an illumination chamber 423. After an exposure to  $h\nu$  in the illumination chamber 423 through the first window plate 451, active chemical reagents are produced and the resulted reactive solution 432 flows through a connection channel 424 into a reaction chamber 425. In the reaction chamber 425 the reactive solution 432 is in contact with immobilized molecules 441 and 442 on the top surface 413 of the microfluidic template 410 and the inner surface 462 of the second window plate 461, respectively. Chemical reactions take place between the active reagents in the reactive solution 432 and the immobilized molecules 441 and 442. Then the effluent 433 flows through an outlet duct 426 into the outlet channel 427.

Please replace the paragraph beginning at page 28, line 4, with the following rewritten paragraph:

Target ~~nucleosides of~~ sequences 15 nucleotides long and complementary to the 5' ends of the probe sequences were chemically synthesized using standard phosphoramidite chemistry on a DNA synthesizer (Expedite 8909, manufactured by PE Biosystems, Foster City, CA 94404, USA). The targets were labeled with fluorescein at the 5' end. Hybridization was performed

using 50 to 100 n ~~molars~~ moles of the targets in 100 micro liters of 6XSSPE buffer solution (0.9 M NaCl, 60 mM Na<sub>2</sub>HPO<sub>4</sub>-NaH<sub>2</sub>PO<sub>4</sub> (pH 7.2), and 6 mM EDTA) at room temperature for 0.5 to 1.0 hours followed by a wash using the buffer solution. A micro-pore-tube peristaltic pump was used to facilitate the solution circulation through the microfluidic array device during the hybridization and wash.